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GB 2257476 A EP 0332766 A DE 004325136 A
DE 003935063 A US 4746808 A US 4272686 A
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(54) A hydroelectric power system

(57) Apparatus for generating electricity comprises a housing 1 which is fitted to an existing drainpipe of a building for locally generating electricity for use within the building. The housing comprises fitting brackets 3, 5 for providing a releasable seal with ends of a drainpipe so that the fluid flowing down the drainpipe flows within the housing 1 through a turbine 9 fitted within the housing 1 to rotate the driveshaft of an alternator fitted within the housing 1. The housing 1 is also provided with a closable drainage port to allow easy access to the housing 1 in the case of a blockage. The apparatus provides a local source of electricity for use within the building, for example, for heating water in a domestic hot water system or for re-charging batteries, e.g., batteries used for computer back-up.

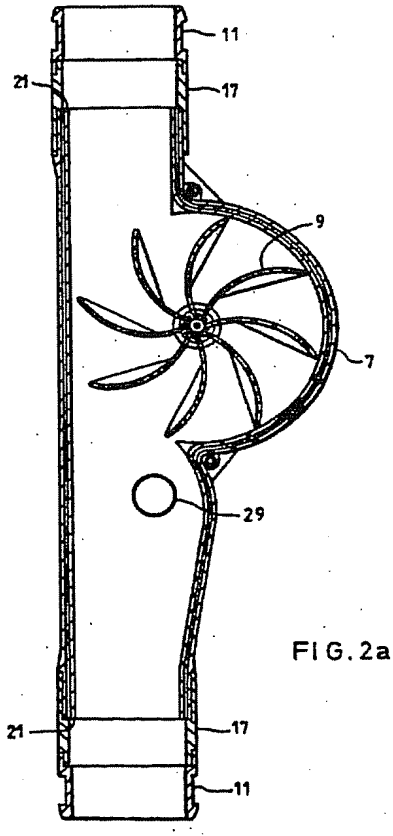

FIG. 2a

GB 2312711 A

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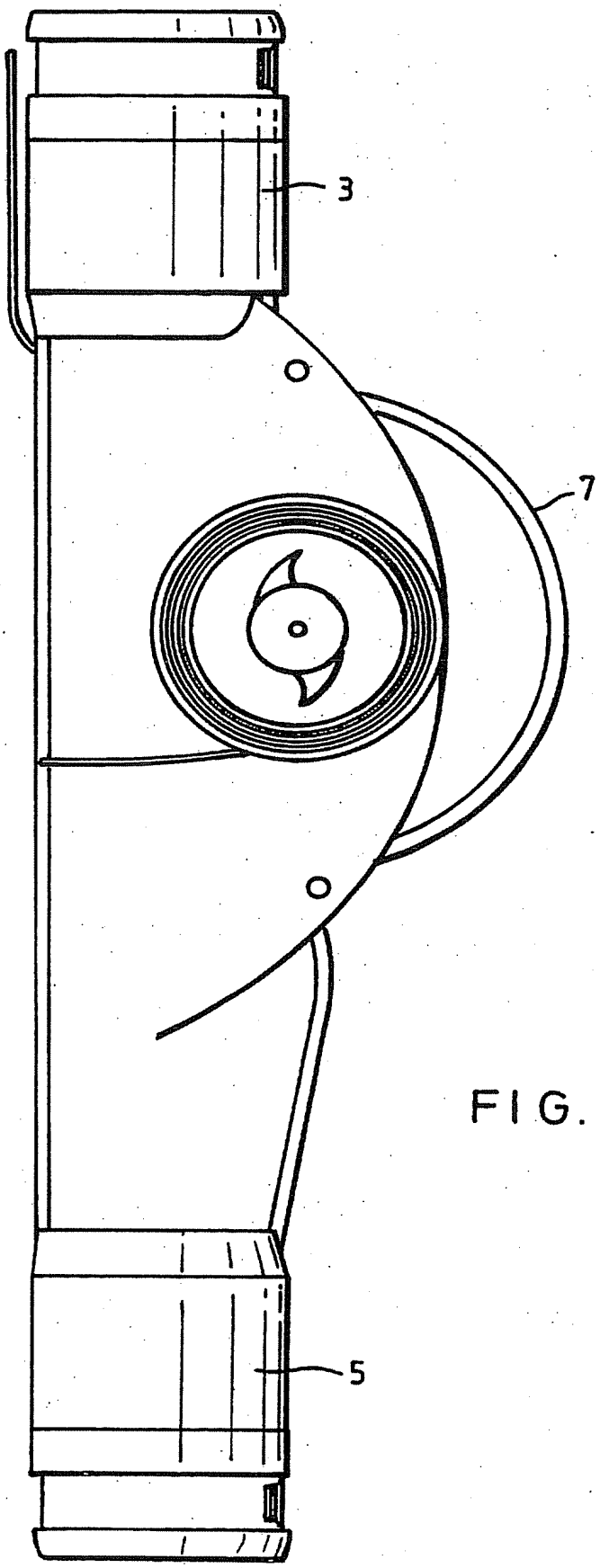

FIG. 1a

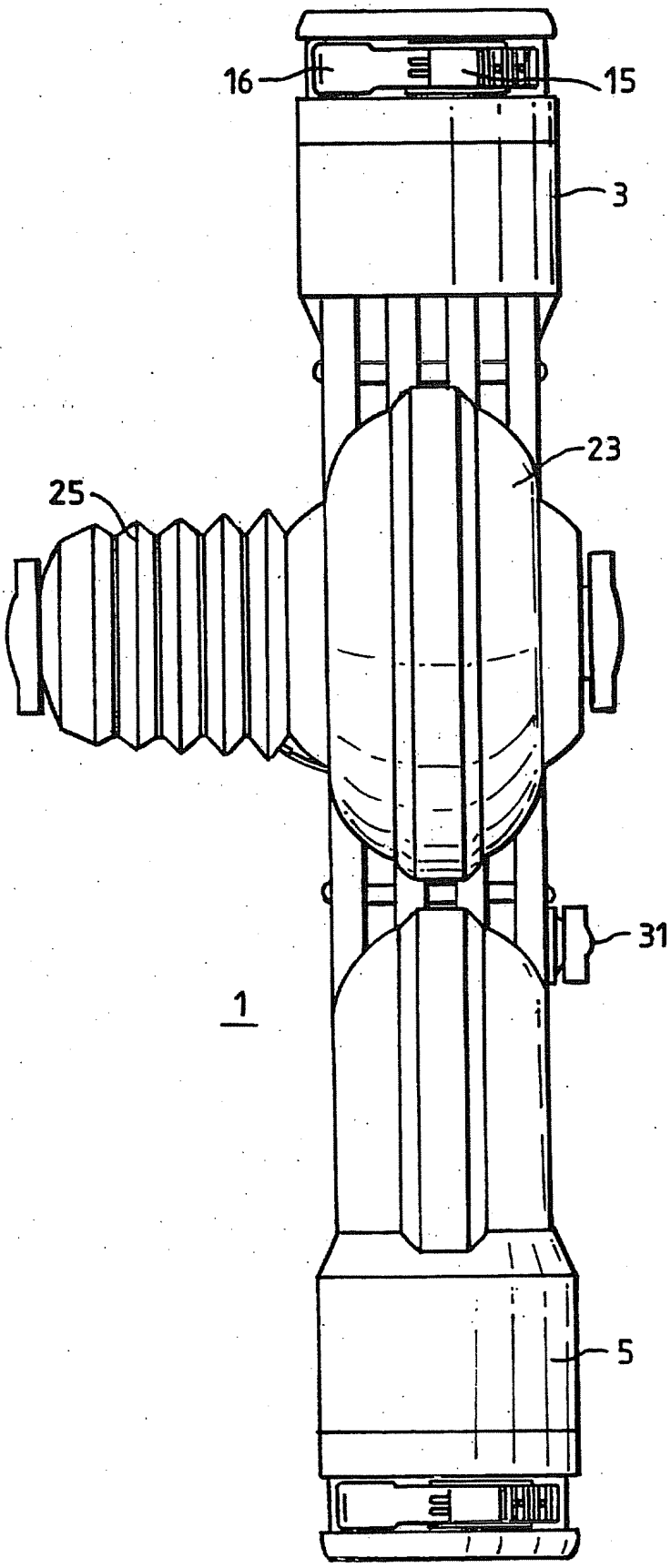

FIG.1b

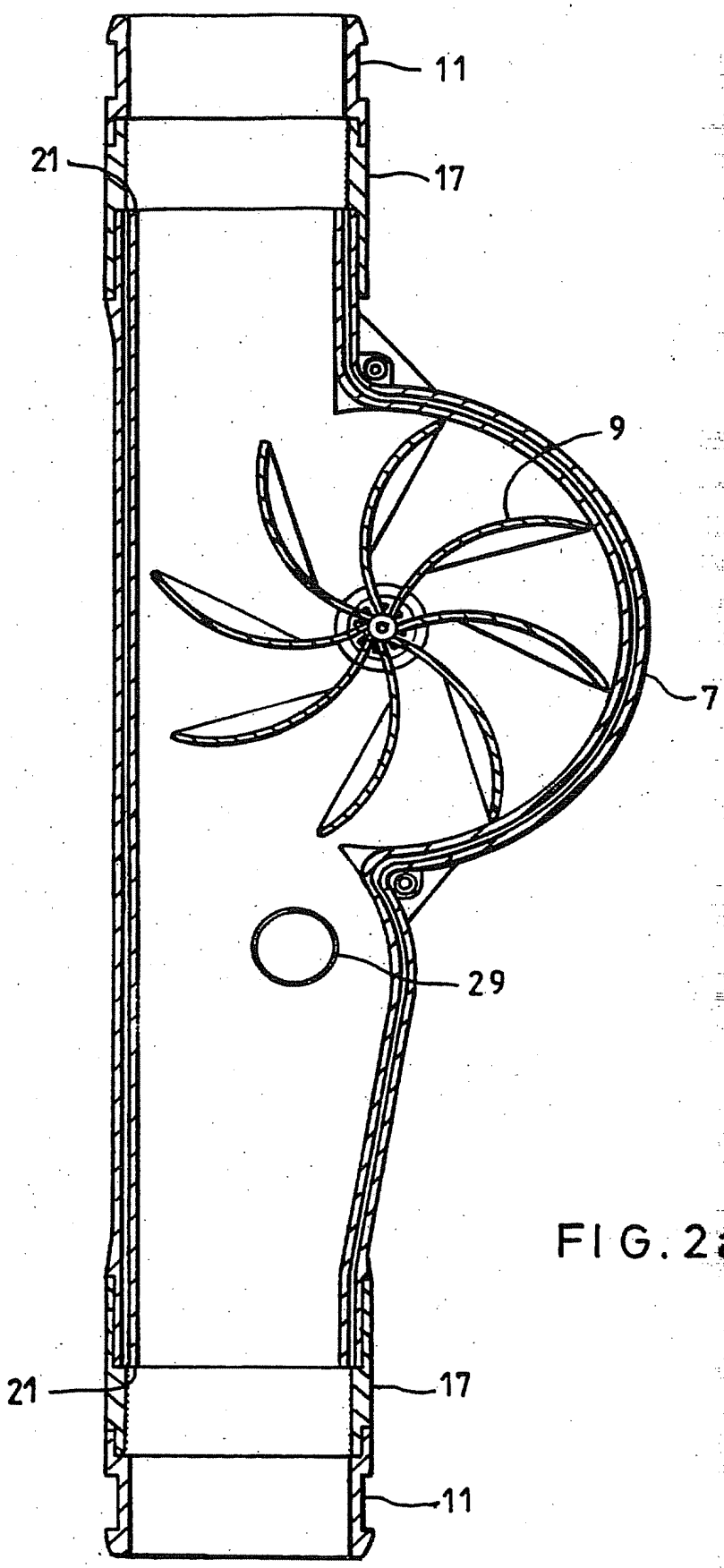

FIG. 2a

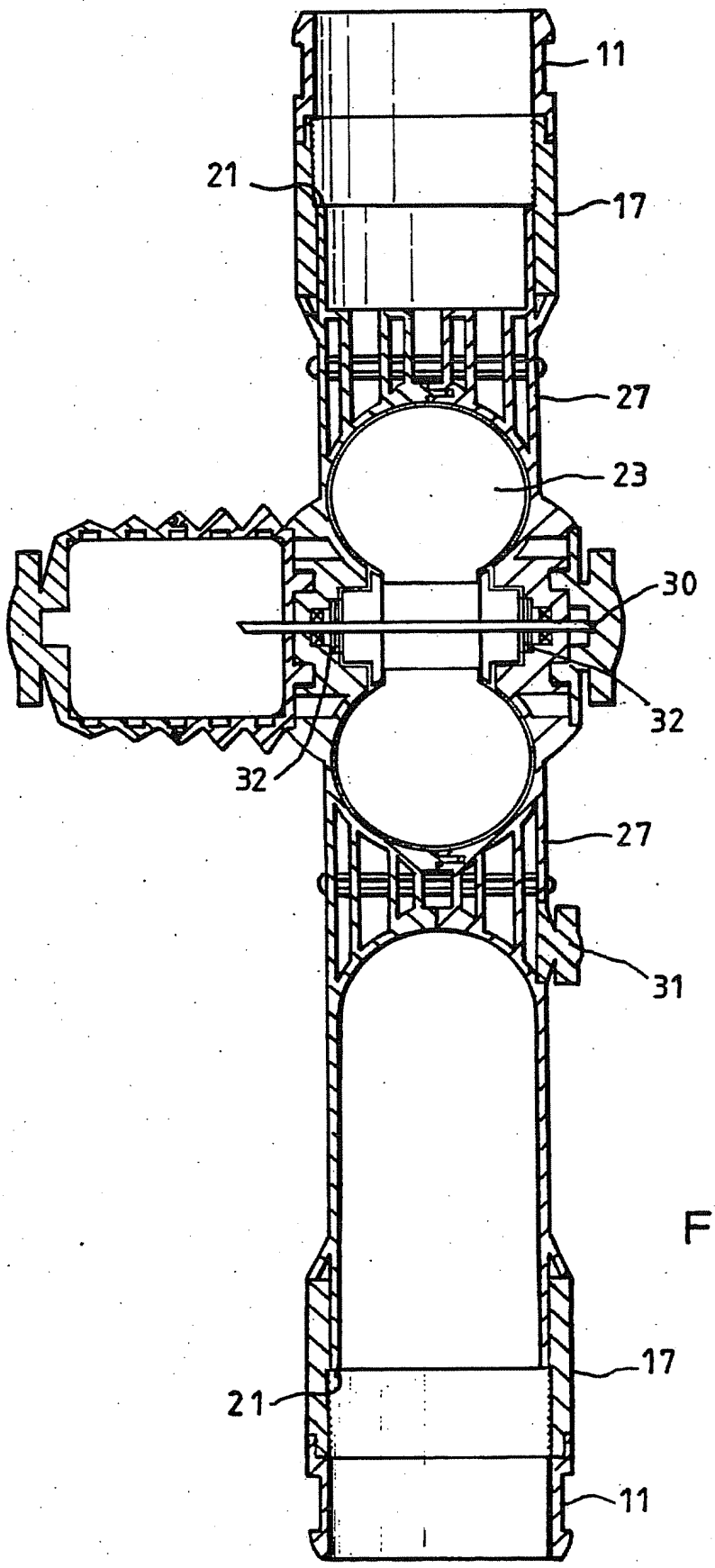

FIG.2b

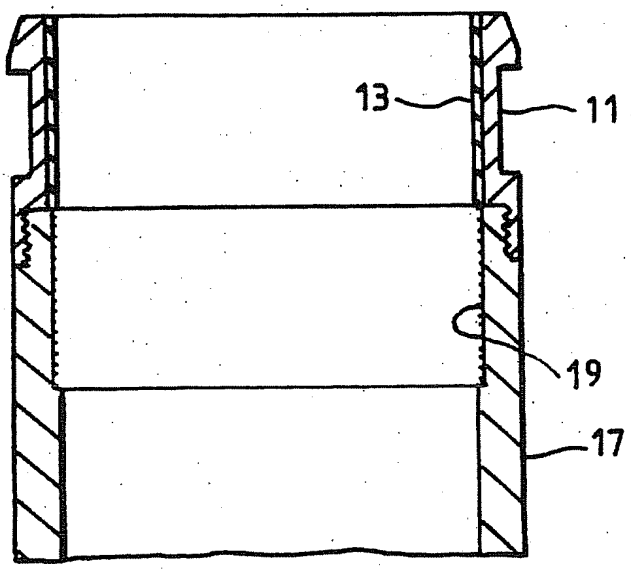

FIG. 3

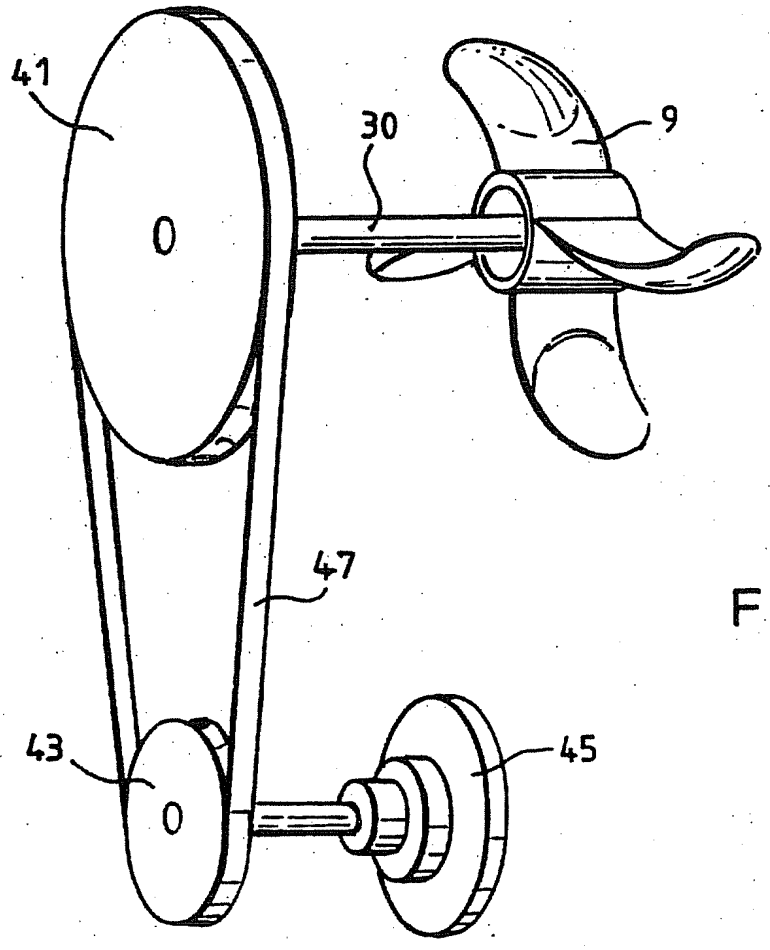

FIG. 4

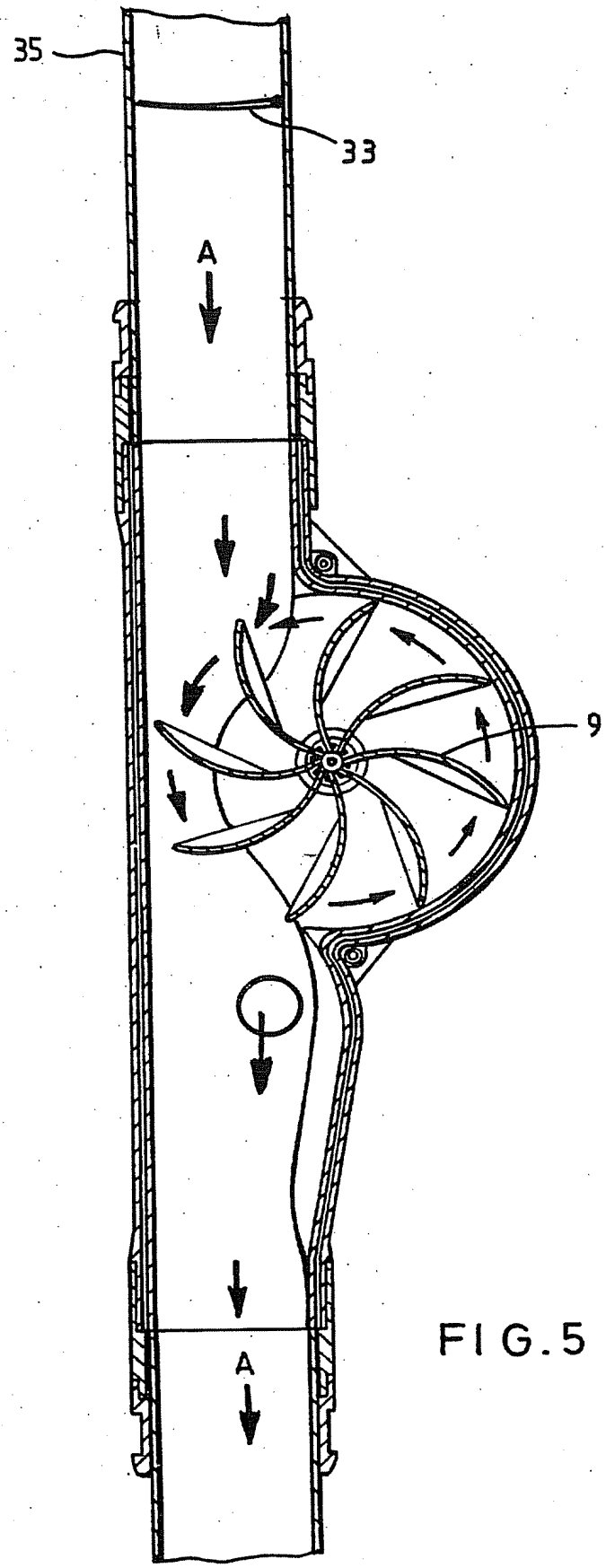

FIG.5

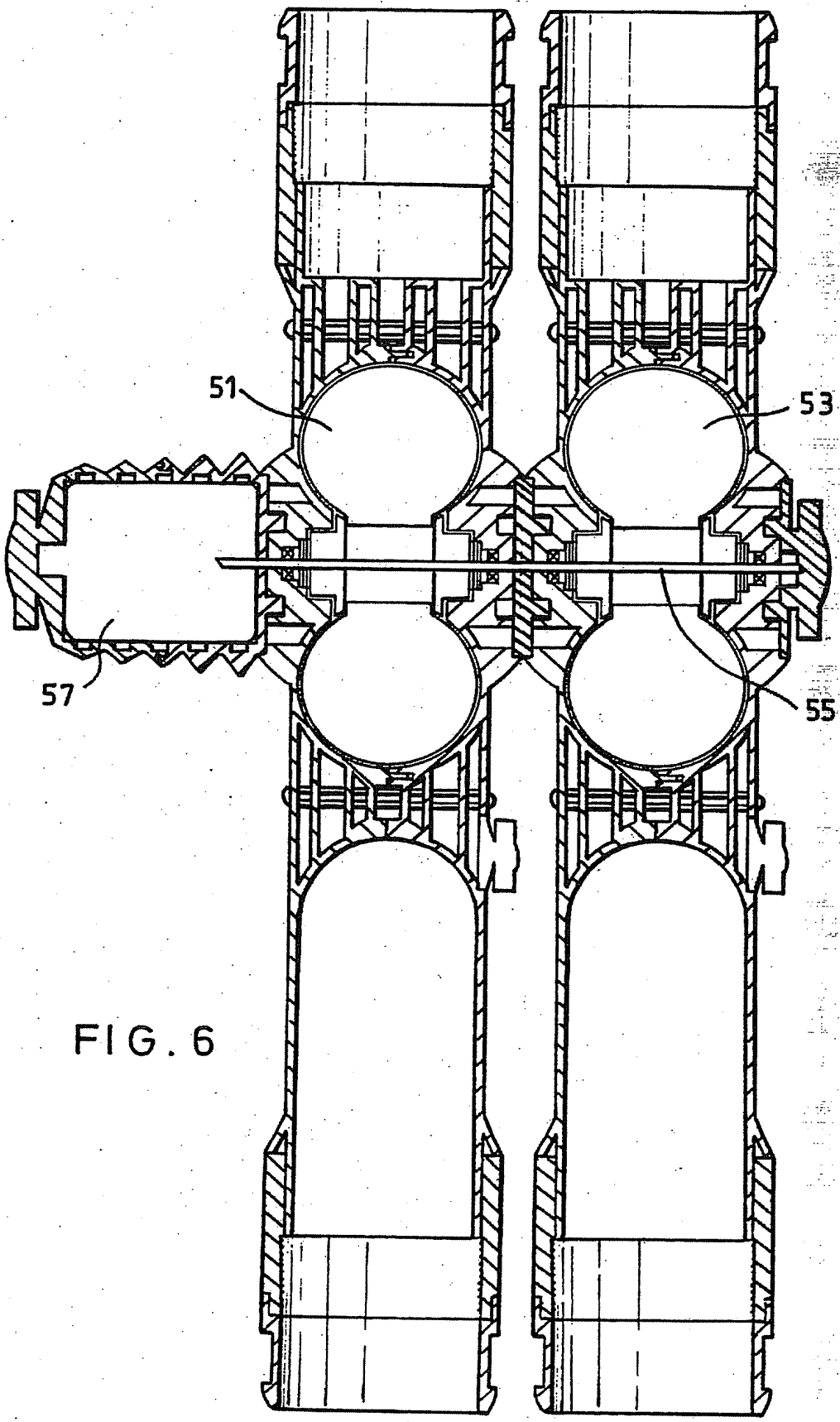

FIG. 6

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A HYDROELECTRIC POWER SYSTEM

This present invention relates to a hydroelectric power system. In particular, it relates to a hydroelectric power system suitable for fitting to a downpipe of a building for locally generating electricity for use within the building.

Hydroelectric power stations produce massive amounts of power, enough to supply electricity to largely populated areas such as towns and small cities. These hydroelectric power stations have several turbines in series and are situated where there is large amounts of natural water travelling at high speed, for example, at the foot of hills or mountains. The electricity generated by such a power station is either generated directly from the water flow or by the pressure build-up of water collected by a dam. In countries where rainfall is frequent, dams are highly practical. However, for countries of low rainfall, dams can cause large-scale environmental damage and invariably are impractical.

With increasing awareness of energy conservation and environmental issues, there has been an increased demand in alternative forms of power generation.

The present invention seeks to provide an improved energy conservation system for a building utilising existing drainage systems, rain water disposal and water supply systems.

In accordance with a first aspect of the present invention, there is provided apparatus for generating electricity comprising a housing, the housing defining a flow path; and a turbine fitted within the housing, wherein the housing comprises fitting means for fitting the housing to a pipe of a building so that the flow path of the pipe is interrupted by the flow path of the housing so that fluid flowing through the pipe turns the turbine.

Preferably, the fitting means releasably seals the housing to a pipe by means of clips so that a section of pipe is removed and the fitting means is easily attached to each end of the cut pipe and is sealed to prevent leakage. The clips enable the housing to be

easily fitted or removed. The fitting means comprises an outer collar, the inner surface of which comprises the seal; an inner collar have a serrated inner surface; and a seat. The ends of the pipe rest against the seat and the serrated surface producing grip between the housing and pipe.

Preferably, the turbine is a Pelton turbine. Although other types of turbine may be suitable, for example, a radial flow (Francis) or a Turgo turbine. The Pelton and Turgo turbines are a known type of turbine which comprises spoon-shaped turbine blades which makes these particularly suitable in a waste water pipe since it is capable of distributing solids. It was found that a Pelton turbine was particularly suitable as it distributes solids move efficiently

The Francis turbine is a known type of radial flow turbine in which water flow in a spiral. The size of the inlet/outlet of the turbine makes it unsuitable for use with water containing solids and is, therefore, more suited for application of a rainwater or inlet supply pipeline. The advantage of the Francis turbine is that it has a direct drive to the alternator, excluding the need for gearboxes and belt drives.

The housing may have an access port which is closable by means of a cap for clearing the housing in the event of a blockage.

Further, the apparatus may comprise an alternator or dynamo which is fitted within the housing and is driven directly by the turbine by means of a common drive shaft. or is driven indirectly, by belt, gears or chains for example.

In one version a pressure release valve which in its closed position blocks the flow path of the pipe and in its open position allows fluid to flow along the flow path of the pipe when a predetermined pressure is reached can be used with the above apparatus. This is particularly suitable for collecting rainwater so that sufficient water can be released to maximise the efficiency of the apparatus.

The apparatus of the present invention can be fitted to a drainpipe of a building which carries waste water or rainwater, or alternatively it can be fitted to the mains water inlet of a building. Further, a plurality of the above mentioned apparatus could be arranged in series so that the turbines are mounted on a common drive shaft to drive an alternator.

In accordance with a second aspect of the present invention, there is provided a method for generating electricity comprising the steps of:

interrupting the flow of fluid in a pipe of a building;

directing the fluid to turn a turbine; and

driving an alternator by rotation of the turbine to generate electricity.

The present invention will now be explained in more detail my means of the following description of preferred embodiments and with reference to the following drawings in which:-

Figures 1A and 1B show side and front elevations of the overall hydroelectric system of a first embodiment of the present invention, respectively;

Figures 2A and 2B show a side view section and a front view section of the hydroelectric system of the first embodiment of the present invention, respectively;

Figure 3 shows details of the fixing bracket of the first embodiment of the present invention;

Figure 4 shows a modification of the drive transmission of the hydroelectric system of the present invention;

Figure 5 shows a modification of the hydroelectric system of the first embodiment of the present invention; and

Figure 6 shows an arrangement of a series of hydroelectric systems of the present invention.

With reference to Figures 1A, 1B, 2A, 2B and 3, the first embodiment of the present invention will be described in more detail below.

The hydroelectric system of the present invention comprises a completely moulded plastic housing 1. The housing 1 has a generally cylindrical shape. Upper and lower cylindrical sections comprise upper and lower fixing brackets 3, 5 located at each end of the housing 1. A middle section 7 between the upper and lower cylindrical sections of the housing 1 is enlarged and houses a turbine 9 and associated motor, not shown.

The fixing brackets 3 and 5, shown in more detail in Figure 3, are dimensioned so that they sealably fit to ends of a conventional drainpipe or water supply pipe. Each bracket comprises an outer collar 11, the inner surface of which comprises a rubber seal

for forming a seal with the drainpipe. The outer collar 11 is provided with a clip 15 which has a ratchet arrangement for varying the diameter of the outer collar 11. A lever 16 of the clip 15 is engaged with the ratchet and is clipped into a position flush with the outer surface of the outer collar 11 to hold it at a preset position and thus fix the diameter of the collar. In this way, the collar diameter can be altered so that the fixing bracket can easily be removed from the drainpipe or sealably fitted to the pipe as required.

Each bracket also comprises an inner collar 17. The inner surface of the inner collar 17 comprises a plurality of silicone ribs 19 to provide additional grip with the pipe and to provide additional seal with the pipe.

Each of the brackets 3 and 5 comprise a circumferential seat 21. The seat 21 provides a rest for each end of the pipe when inserted into each bracket. Once fitted, the inner diameter of the drainpipe is then continuous with the inner diameter of the cylindrical sections of the housing 1.

The middle section 7 comprises an enlarged portion of a generally toroid shape in which the geometric centre of the toroid is perpendicular to the longitudinal axis of the drainpipe. The middle section 7 also comprises a motor housing 25 which extends from the centre of the toroid section 23 so that the axis of symmetry of the motor housing 25 coincides with the geometric centre of the toroid 23.

The toroid section is supported by support means 27. The lower section of the middle section has an outlet 29 which a sealing cap 31 for providing access in the case of a blockage.

The turbine 9 is rotatable about the geometric centre of the toroid so that the blades of the turbine 9 rotate around a circular path, the circular path extending into the cylindrical sections of the housing 1. A suitable type of turbine would be a Pelton turbine. Such a turbine has the capability of operating in conditions with more than one directed jet of water. This type of turbine is also easy to manufacture as it can be cast in one piece. The turbine is fitted so that water and debris is funnelled into the centre of the pipe without loss of speed and is guided directly through the turbine impellers without blocking the drainpipe. An alternative turbine would be, for example, a Turgo turbine. These turbines are particularly suited to use with waste water since they are

capable of distributing solids within the waste water. They comprise generally spoon-shaped turbine blades.

The drive shaft 30 of the motor is common with the axis of rotation of the turbine so that rotation of the turbine drives the motor by rotation of the drive shaft and generates electricity. Alternatively, it can be indirectly driven by means of gears, belts or chains for example. An optimum gearing ratio for such a transmission system would be 6:1 to increase rpm of the motor. Such a system is shown, for example in figure 4. The drive shaft 30 of the turbine 9 is connected to a gear wheel 41 which drives the gear 43 of the motor 45 by means of a belt or chain 47.

The drive shaft 30 comprises a pair of seals 32 to seal the toroid section.

The housing 1 is fitted to the base of an existing drainpipe of a building or to a mains water inlet. This is achieved by cutting away a section of the drainpipe of approximately 60cm and fitting the brackets 3, 5 of the housing to each of the ends of the drainpipe. In fitting it at the base of the drainpipe, use can be made of increased speed of flow of the waste water due to the height through which the waste water falls, therefore maximising the efficiency of the system.

Wastewater is discharged down the drainpipe and passes through the system rotating the turbine. This rotates the driveshaft of the alternator generating electricity. A type of alternator suitable for this application is an induction motor. The output of the system can be used to provide electricity for heating water or for recharging a battery, for examples, batteries used for computer back-up in offices. Of course for indirect drive transmission, a d.c. motor could be used.

The fitting of the hydroelectric system is provided with a simple clip 15. Therefore, the system could be fitted by a householder capable of simple decorating and maintenance work or indeed any person familiar with do-it-yourself (D-I-Y) techniques. The drainpipe is cut to give a gap of appropriate length and the system is fitted into the gap, the brackets 3 and 5 providing a seal with the drainpipe by means of the simple clip mechanism. The housing 1 is a complete unit which is easily fitted and removed as required. It provides a watertight housing for the motor so that water cannot ingress, thereby damaging the motor.

The alternator can provide a 12-volt output or other voltage as required and is suitable for powering a water heater or recharging a battery.

The hydroelectric system described above may also be fitted to a rainwater drainpipe as shown in the second embodiment of the present invention in Figure 5.

A pressure release valve 33 can be provided above the turbine 9 so that rainwater is collected within the drainpipe 35. When a certain height of water is reached, the pressure release valve 33 can be opened and the water stored is allowed to flow in the direction of the arrows A, and turn the turbine blades. Since the rainwater contains very little debris, only a small outlet is necessary making a Francis turbine or radial flow turbine suitable in this case. Of course, the modified transmission shown in Figure 4 could also be utilised in the system of the second embodiment of the present invention.

Figure 6 shows an arrangement in which two or more substantially identical systems may be assembled side by side. Each of the turbine housing 51, 53 are mounted on a common shaft 55 driving a single alternator or power generator provided in a housing 57. The arrangement could be utilised for different pipes within a building, for example, one system could be provided as a waste pipe and the other as the rain water drainpipe or mains inlet supply. This would provide an increased power output.

In the light of this disclosure, modifications of the described embodiments as well as other embodiments, all within the scope of the appended claims will now become apparent to persons skilled in the art.

CLAIMS:

1. Apparatus for generating electricity comprising a housing, the housing defining a flow path; and a turbine fitted within the housing, wherein the housing comprises fitting means for fitting the housing to a pipe of a building so that the flow path of the pipe is interrupted by the flow path of the housing so that fluid flowing through the pipe turns the turbine.

2. Apparatus according to claim 1, wherein the fitting means has a seal for sealing the housing to a drainpipe.

3. Apparatus according to claim 2, wherein the fitting means has clip means for releasably sealing the housing to a pipe.

4. Apparatus according to claim 2 or claim 3, wherein the fitting means comprises an outer collar, the inner surface of which comprises the seal; an inner collar have a serrated inner surface; and a seat.

5. Apparatus according to any of claims 1 to 4, wherein the housing has an access port which is closable by means of a cap.

6. Apparatus according to any one of claims 1 to 5, wherein the apparatus further comprises a pressure release valve which in its closed position blocks the flow path and in its open position allows fluid to flow along the flow path when a predetermined pressure is reached.

7. Apparatus according to any one of claims 1 to 5, wherein the turbine comprises generally spoon-shaped turbine blades.

8. Apparatus according to claim 7, wherein the turbine is a Pelton turbine.

9. Apparatus according to claim 6, wherein the turbine is a radial flow turbine.

10. Apparatus according to any of claims 1 to 9, wherein the apparatus further comprises an alternator which is fitted within the housing and is driven directly by the turbine.

11. A drainpipe having fitted thereto, an apparatus according to any preceding claim.

12. A building comprising the drainpipe of claim 11.

13. An assembly for generating electricity comprising a plurality of apparatus according to any one of the preceding claims 1 to 9, wherein the plurality of turbines are connected to a common drive shaft to drive an alternator.

14. A method for generating electricity comprising the steps of:
interrupting the flow of fluid in a pipe of a building;
directing the fluid to turn a turbine; and
driving an alternator by rotation of the turbine to generate electricity.

15. Apparatus for generating electricity as hereinbefore described with reference to any one of the accompanying drawings.

16. A method for generating electricity, the method as hereinbefore described with reference to any one of the accompanying drawings.

The Patent Office

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Application No: GB 9608705.1 **Examiner:** Ian Philpot
Claims searched: all **Date of search:** 29 July 1996

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): F1T (TA)

Int Cl (Ed.6): F03B (1/00, 7/00, 13/00, 13/10, 17/06)

Other: Online WPI (Questel)

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2257476 A	(AIRDRI) See whole doc.	1,6.
X	EP 0332766 A	(DOLEH) See col 1 line 39.	1-6.
X	US 4746808 A	(KAESER) See col 1 lines 46-50.	1, 7-9, 14.
X	US 4272686 A	(SUZUKI) See Fig. 1 & col 1 lines 45-65.	1, 2, 6, 11, 12.
X	US 4246753 A	(REDMOND) See col. 1 lines 9-25.	1, 6, 9-12, 14.
X	DE 4325136 A	(TWELENKAMP) See whole document	1, 6-12, 14.
X	DE 3935063 A	(BOXHAMMER) See whole document	1, 11, 12.

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
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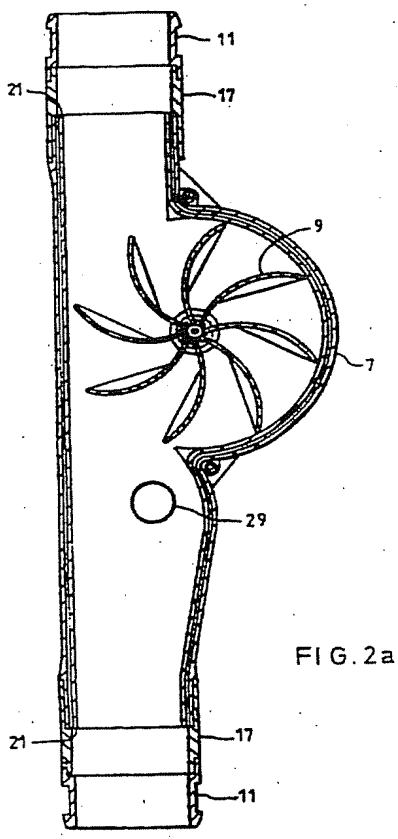

FIG. 2a

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